HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Salmon Creek Summer Chum Salmon Supplementation
Species or Hatchery Stock:	Summer chum salmon, *Oncorhynchus keta*, Salmon Creek stock
Agency/Operator:	Washington Department of Fish and Wildlife / Wild Olympic Salmon
Watershed and Region:	Salmon Creek, Discovery Bay, Strait of Juan de Fuca, Washington State
Date Submitted:	February 28, 2000
Date Last Updated:	March 26, 2001

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Salmon Creek summer chum salmon supplementation

1.2) Species and population (or stock) under propagation, and ESA status.

Summer chum salmon, *Oncorhynchus keta*, Salmon Creek stock;
Hood Canal/Strait of Juan de Fuca Summer Chum ESU: Threatened

1.3) Responsible organization and individuals

Agency lead contact:

Name (and title):	Thom H. Johnson, WDFW, District Fish Biologist
Agency or Tribe:	Washington Dept. of Fish and Wildlife (WDFW)
Address:	283236 Highway 101, Port Townsend, WA 98368
Telephone:	(360) 765-3979
Fax:	(360) 765-4455
Email:	johnsthj@dfw.wa.gov

On-site operations staff leads:

Name (and title):	Ginna Correa, WDFW, Fish and Wildlife Biologist Cheri Scalf , WOS, trained volunteer
Agency or Tribe:	WDFW
Address:	283236 Highway 101, Port Townsend, WA 98368
Telephone:	(360)344-3069 (G. Correa) (360) 379-9516 (C. Scalf)
Fax:	(360) 765-4455
Email:	corregcc@dfw.wa.gov (G. Correa) salal@olympus.net (C. Scalf)

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program: trained volunteers provided by WOS; some funding and Labor and Industries insurance for volunteers provided through Regional Fish Enhancement Group North Olympic Salmon Coalition (NOSC); Point No Point Treaty Council and tribes

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Source: WDFW, NOSC, WOS.
Staffing: oversight and support provided by WDFW fish biologist, habitat biologist, fish health specialist, and Dungeness Hatchery Complex personnel; hatchery operations staffed by trained volunteers with Wild Olympic Salmon
Operational costs: ~ $3000-7000 for operation of Salmon Creek Hatchery; plus additional costs for WDFW staff time (estimate can be provided)

1.5) Location(s) of hatchery and associated facilities.

Broodstock collection: at trap on Salmon Creek (WRIA 17.0245) at RM 0.2.
Dungeness Hatchery: located on Dungeness River (WRIA 18.0018) at RM 10.6; eggs and milt transported to Dungeness Hatchery for fertilization, initial incubation, and otolith marking; eyed eggs transported to Salmon Creek Hatchery.
Salmon Creek Hatchery: located at RM 0.2 on Houck Creek (WRIA 17.0248), tributary to Salmon Creek (17.0245) at RM 2.5, tributary to Discovery Bay, Strait of Juan de Fuca; egg incubation, hatching, and initial rearing.
Saltwater net pens: located on west side of Discovery Bay about 1 mile from mouth of Salmon Creek and < 1/3 mile from Salmon Creek tidal channel; transported from Salmon Creek Hatchery as fed fry for final rearing and release.

1.6) Type of program.

Integrated Recovery

1.7) Purpose (Goal) of program.

Restoration. The goal of this program is to contribute to the restoration of a healthy, natural, self-sustaining population of summer chum salmon that will maintain the genetic characteristic of the native stock. An additional goal is to serve as a donor stock to support the reintroduction of summer chum salmon into Chimacum Creek; this reintroduction shall represent a range extension of the Salmon/Snow stock.

1.8) Justification for the program.

Salmon/Snow Creek summer chum salmon was identified as a stock at "high risk" and selected as a supplementation project in the Summer Chum Salmon Conservation Initiative (SCSCI) developed by Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes (2000). This program is fully consistent with the rationale, intent, and implementation of the supplementation approach identified in the SCSCI. The following is taken from the SCSCI:

Supplementation is viewed as an effective tool, in combination with other management actions, for restoring natural production to healthy levels within the Hood Canal/Strait of Juan de Fuca summer chum ESU. By the early 1990s, summer chum populations had declined to such low levels that the risk of extinction to portions of the ESU on the short term was high. Furthermore, with the recent extirpation of four populations, the need for hatchery-based actions was identified to reintroduce summer chum into vacant habitat that, based on stock assessment data, appeared unlikely to be colonized naturally within a reasonable time frame. The need to quickly boost the population sizes above critically low levels, and the fact that some factors limiting production, such as harvest and habitat degradation, were in the process of being addressed also contributed to the decision to use supplementation.

The intent of supplementation efforts within this ESU is to reduce the short term extinction risk to existing wild populations and to increase the likelihood of their recovery to a healthy status. These objectives can be accomplished through the establishment of supplemented populations using indigenous brood stock, and through reintroduction of appropriate populations into streams now lacking summer chum. In keeping with the intended ephemeral nature of this form of artificial production, the proposed supplementation strategy will be limited in duration and designed to help maintain the populations while potential factors for decline are identified and being addressed. Monitoring and evaluation activities proposed for the programs will provide important new scientific information regarding the effectiveness of supplementation as it relates to chum salmon. Contribution to the re-establishment of naturally functioning ecosystems through the recovery or restoration of summer chum populations, is also an intent.

The supplementation focus at this time is on recovery of "at risk" stocks and reintroduction of extirpated populations. This current emphasis is in response to the generally poor condition of the stocks within the ESU. For "at risk" populations chosen through this program for supplementation, hatchery production of fed fry of large size relative to natural fry, released at the proper migration time, will provide a survival advantage that will improve the status of the populations more rapidly than is possible through natural production alone. The immediate objective for these populations will be to boost the population abundance as quickly as possible, increasing natural spawner densities to sustainable levels that will alleviate the risk of extinction to the populations. For selected, extirpated populations, seeding of usable habitats will be accomplished through reintroduction strategies developed specifically for each recipient watershed. Reintroduction planning strategies will include selection of the most appropriate donor stock, acclimation to the recipient location, and release of fed chum fry to maximize the likelihood for the establishment of a population.

1.9) List of program "Performance Standards".

The following are objectives for using supplementation in the recovery of the Salmon/Snow summer chum stock as presented in the SCSCI (2000):

Objective 1: Retain future options for recovery of the Salmon/Snow stock. Develop and maintain, for 12 years (beginning in 1992), a population comprised of supplemented and naturally spawning fish using hatchery and wild-origin broodstock on Salmon Creek.

Objective 2: Boost the numbers of naturally produced fish in Salmon Creek using the indigenous population as the donor. Procure no greater than 20 % of the total annual number of returning females when the spawning population exceeds 250 fish. If the spawning population is less than 250, follow broodstock removal

criteria set forth for small population sizes. Produce approximately 60,000 fed fry (with a maximum of 123,000 fed fry) each year for release from net-pens situated adjacent to the mouth of Salmon Creek in Discovery Bay.

Objective 3: Monitor and evaluate the effectiveness of the supplementation program (see 1.10, below). Report the results of the program each year.

Objective 4: Support reintroduction of summer chum into Chimacum Creek. Procure an additional 39 spawning pairs to produce a maximum of 86,000 fed fry each year for release into Chimacum Creek.

Objective 5: Manage Snow Creek as a wild production area. Supplementation in this watershed is an option in the future if this portion of the population is not able to recover on its own.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

This program is fully consistent with the intent and implementation of the monitoring and evaluation component for supplementation programs identified in the SCSCI. The monitoring and evaluation program in the SCSCI responds to concerns regarding the uncertainty of summer chum supplementation and reintroduction effects by addressing the following four elements :

1. The estimated contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process;

2. Changes in the genetic, phenotypic, or ecological characteristics of populations (target and non-target) affected by the supplementation/reintroduction program;

3. The need and methods for improvement of supplementation/reintroduction activities in order to meet program objectives, or the need to discontinue a program because of failure to meet objectives; and

4. Determination of when supplementation has succeeded and is no longer necessary for recovery.

1.10.1) "Performance Indicators" addressing benefits.

Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.

1. Differentially mark all hatchery-origin summer chum fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.

2. Conduct spawning ground surveys throughout the summer chum return to enumerate spawners, and to collect information regarding fish origin (via random sampling of fish heads for otoliths), and age class composition through scale sampling.

3. Estimate the number of naturally spawning hatchery-origin summer chum contributing to each supplemented population's annual escapement.

Element 4: Collect and evaluate information on adult returns.

1. Commencing with the first year of returns of progeny from naturally-spawned, hatchery-origin summer chum, evaluate results of spawning ground surveys and age class data collections to:

a. Estimate the abundance and trends in abundance of spawners;
b. Estimate the proportion of the escapement comprised by chum of hatchery lineage, and of wild lineage;
c. Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

Using the above information, determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and wild proportions will be determined by implementation plans, budgets, and assessment priorities.

1.10.2) "Performance Indicators" addressing risks.

Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.

1. Monitor escapements of non-supplemented populations to determine the level of straying of supplementation program-origin fish to other drainages.

Element 2: Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations presently affected by the supplementation program.

1. Collect additional GSI data (allozyme or DNA-based) from regional summer chum adult populations to determine the degree to which discrete populations exist in the individual watersheds.

2. Continue GSI allozyme collections of summer chum spawners throughout the region

for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program has negatively affected the genetic diversity of natural populations.

3. Continue collecting and archiving DNA samples for future analysis.

Element 3: Determine the need, and methods, for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.

1. Determine the pre-spawning and green egg to released fry survivals for each program at various life stages.
   a. Monitor growth and feed conversion for summer chum fry.
   b. Determine green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
   c. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for fed fry.
   d. Summarize results of tasks for presentation in annual reports.
   e. Identify where the supplementation program is falling short of objectives, and make recommendations for improved fry production as needed.

2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
   a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
   b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site.
   c. Maintain daily records of trap operation and maintenance (e.g. time of collection), number and condition of fish trapped, and environmental conditions (e.g. river stage, tide, water temperature).
   d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.
   e. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW (or USFWS for federal agency operations) will monitor fish health.
   a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.
   b. The incidence of viral pathogens in summer chum broodstock will be determined

by sampling fish at spawning in accordance with procedures set forth in the "Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).

c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.

d. Fish health monitoring results will be summarized in an annual report.

Element 4: Collect and evaluate information on adult returns.

This element will be addressed through consideration of the results of previous "Elements 1., 2., and 3.", and through the collection of information required under adaptive criteria that will be used as the basis for determining when to stop a supplementation or reintroduction program.

1. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in each supplementation program for use as baseline data to document any phenotypic changes in the populations.

2. Compare newly acquired electrophoretic analysis data reporting allele frequency variation of returning hatchery and wild fish with baseline genetic data. Determine if there is evidence of a loss in genetic variation (not expected from random drift) that may have resulted from the supplementation program..

1.11) Expected size of program.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish). 240 adult summer chum salmon (96 females and 144 males)

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location.

Life Stage	Release Location	Annual Release Level
Eyed Eggs	Chimacum Creek	86,000 fed fry equivalents
Unfed Fry		
Fry	Salmon Creek	123,000
Fingerling		
Yearling		

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

The following is based on the recovery of otolith-marked adults released as fry from the supplementation program. Beginning with the 1997 return year, adults randomly collected for brood stock at Salmon Creek and carcasses randomly sampled from Salmon Creek natural spawning grounds were sampled for otoliths. All supplementation-origin fish returning during 1997 or 1998 did not receive a detectable otolith mark as fry, so the smolt-to-adult survival rate and total adult return of supplementation-origin fish is considered a minimum. Analysis of otoliths collected during 2000 will be available in early 2001.

Source: Thom H. Johnson, WDFW, memo dated November 3, 2000.

Return from fry to adult for summer chum salmon reared in supplementation program at Salmon Creek, as determined from otolith marks for the 1994, 1995 and 1996 brood years

Stream	Brood year	No. of fry released	Return year	Age	No. of otolith-marked adults	Return rate by age
Salmon Cr.						
	1994	2,000	1996	2	--	--
			1997	3	46	2.30%
			1998	4	50	2.50%
			1999	5	0	0.00%
				Total	96	4.80%
	1995	38,800	1997	2	13	0.03%
			1998	3	471	1.21%
			1999	4	148	0.38%
			2000	5		
				Total	632	1.63%
	1996	62,000	1998	2	8	0.01%
			1999	3	219	0.35%
			2000	4		
			2001	5		
				Total	227	0.37%

In 1999, an estimated thirty-eight (38) age 3 summer chum adults returned to Chimacum Creek from the initial 1996 brood year reintroduction release. In

2000, estimated escapement was 52 summer chum adults in Chimacum Creek, comprised of 11.4% age 2, 51.4% age 3, and 37.1% age 4 fish (pers. comm., T. H. Johnson, WDFW).

1.13) Date program started (years in operation), or is expected to start.
Brood year 1992; brood year 2000 is ninth year of operation

1.14) Expected duration of program.
This program is fully consistent with the standards presented in the SCSCI. Expected maximum duration is three generations (12 years).

1.15) Watersheds targeted by program.
Salmon Creek (WRIA 17.0245); Chimacum Creek (WRIA 17.0203).

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.
Alternative actions considered and implemented include integration with habitat and harvest recovery measures identified in SCSCI.

SECTION 2. PROGRAM EFFECTS ON ESA-LISTED SALMONID POPULATIONS.

2.1) List all ESA permits or authorizations in hand for the hatchery program.
None in hand; ESA listings are new in this area.

2.2) Provide descriptions, status, and projected take actions and levels for ESA-listed natural populations in the target area.

2.2.1) Description of ESA-listed salmonid population(s) affected by the program.

The following is paraphrased from life history information for Hood Canal and Strait of Juan de Fuca summer chum presented in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000):

Hood Canal and Strait of Juan de Fuca summer chum populations are one of three genetically distinct lineages of chum salmon in the Pacific Northwest region; and were designated as an evolutionarily significant unit (ESU) based upon distinctive life history and genetic traits. The uniqueness of the summer chum life history is best characterized by their late summer entry into freshwater spawning areas, and their late winter/early spring arrival in the estuaries as seaward-migrating juveniles. Reproductive isolation has been afforded by a significantly different migration and escapement timing and geographic separation from other chum stocks.

Summer chum spawning occurs from late August through late October. Eggs eye in redds after about 4 to 6 weeks incubation and hatch about 8 weeks after spawning. Fry emerge from redds, usually with darkness, between February and late May and immediately commence migration downstream to estuarine areas. Summer chum fry initially inhabit nearshore areas and occupy sublittoral seagrass beds for about one week and are thought to be concentrated in the top few meters of the water column both day and night. Upon reaching a size of 45-50 mm, fry move to deeper offshore areas. Migrating at a rate of 7-14 km per day, the southernmost outmigrating summer chum fry population in Hood Canal would exit the Canal 14 days after entering seawater (90% of population exits by April 28 each year, on average); and Strait of Juan de Fuca summer chum would exit the Discovery Bay area 13 days after entering seawater (90% completion by June 8 each year, on average).

Summer chum mature primarily at 3 and 4 years of age. The southerly ocean migration down the Pacific Northwest coast from rearing areas in the northeast Pacific Ocean likely commences in mid-July and continues through at least early September. Adults enter terminal areas from early August through late September, with spawning ground entry timing in Hood Canal from late August through mid-October and in Strait of Juan de Fuca from early September through mid-October. Hood Canal and Strait of Juan de Fuca summer chum typically spawn soon after entering freshwater in the lowest reaches of natal streams. Low summer-time flows likely have acted to confine summer chum spawning in this region to the lowest reaches.

- Identify the ESA-listed population(s) that will be <u>directly</u> affected by the program.
The program will lead to recovery of Snow/Salmon and Chimacum summer chum salmon which are stocks identified as part of the Hood Canal/Strait of Juan de Fuca Summer Chum ESU.

- Identify the ESA-listed population(s) that may be <u>incidentally</u> affected by the program.
The program may incidentally affect chinook salmon in the Puget Sound Chinook ESU (by providing additional prey base for chinook). It is not anticipated that the program will impact bull trout since none are known to be present in the area of the program.

2.2.2) Status of ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds.

In the SCSCI, the Snow/Salmon Creek summer chum stock is identified as "depressed" due to chronically low escapements. In addition, a risk assessment using procedures for measuring extinction risk as presented by Allendorf et al. (1997) was done and the current risk of extinction was judged to be low. However, at the time supplementation was initiated in 1992, this stock would have been judged to be at high risk of extinction.

In the SCSCI, the Chimacum Creek summer chum stock is identified as "extinct" since no summer chum have been observed since the mid-1980's.

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.
Data are not presently available for the natural population, but are being collected.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data.

Source of natural spawning abundance data is SCSCI (for 1987 through 1998) and WDFW files (for 1999 and 2000); does not include adults collected for broodstock from 1992 through 2000 (see 7.4.2):

	Salmon Creek	Snow Creek
1987	1062	465
1988	1915	723
1989	194	21
1990	245	33
1991	172	12
1992	371	21
1993	397	11
1994	137	2
1995	538	25
1996	785	160
1997	724	67
1998	1023	27
1999	434	29
2000	710	30

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

The following is based on the recovery of otolith-marked adults released as fry from the supplementation program. Beginning with the 1997 return year, adults randomly collected for brood stock at Salmon Creek and carcasses randomly sampled from Salmon Creek natural spawning grounds were sampled for otoliths. All supplementation-origin fish returning during 1997 or 1998 did not receive a detectable otolith mark as fry, so the proportion of known supplementation-origin fish is considered a minimum.

Source: Thom H. Johnson, WDFW, memo dated November 3, 2000.

Return from fry to adult for summer chum salmon reared in supplementation program at Salmon Creek, as determined from otolith marks for the 1997, 1998 and 1999 return years.

								Supplementation program		
Stream	Return year	Total return	Age	Age comp. (%)	No. of adults	Otolith marks (%)	No.	Brood year	No. of fry released	Return rate by age
Salmon Cr.										
	1997	834	2	3.6%	30	44.4%	13	1995	38,800	0.03%
			3	64.3%	536	8.6%	46	1994	2,000	2.29%
			4	30.5%	255	2.7%	7	1993	44,000	0.02%
			5	1.6%	13	0.0%	0	---	---	---
						7.9%	66			
	1998	1134	2	0.7%	8	100.0%	8	1996	62,000	0.01%
			3	60.0%	680	69.2%	471	1995	38,800	1.21%
			4	39.3%	446	11.2%	50	1994	2,000	2.50%
			5	0.0%	0	0.0%	0	1993	44,000	0.00%
						46.6%	528			
	1999	499	2	0.0%	0	0.0%	0	1997	71,800	0.00%
			3	58.2%	290	75.2%	219	1996	62,000	0.35%
			4	40.7%	203	72.9%	148	1995	38,800	0.38%
			5	1.1%	6	0.0%	0	1994	2,000	0.00%
						75.7%	367			

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of listed fish in the target area, and provide estimated annual levels of take</u>.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

Listed summer chum salmon adults will be trapped and collected for broodstock from August through October and result in a take. Other listed summer chum adults will be trapped, handled, and passed upstream during trap operation and may lead to injury to listed fish through delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation. The trap is located on private property, accessed through three gates maintained by the property owner. Human disturbance or poaching of summer chum held in the trap have not been experienced during the duration of operation. Chinook salmon are not indigenous to Salmon Creek, and takes of listed chinook are not anticipated through the broodstock collection program. Any straying chinook salmon encountered in the trap will be passed by hand upstream daily, above the weir, with minimal delay.

Incubation and rearing of summer chum from September through April has a high potential to take listed summer chum due to natural mortality causes and due to fish culture activities and conditions which affect fish health and development including handling procedures, fertilization procedures, water temperature, water quality, water flow, feeding success, and transport and/or transition from fresh to saltwater environments. Risk aversion measures minimize the likelihood for the take of listed summer chum (see 5.8). No take of other listed salmonids due to these activities is anticipated.

Physical harm of reared summer chum at release (March through May) due to descaling or increased susceptibility to predation at release has a potential to take listed summer chum, but has been minimal to date. No take of other listed salmonids is anticipated.

The contact with summer chum during spawner escapement surveys (August through October), carcass recovery programs (September and October), and other monitoring and evaluation programs has a potential to take listed summer chum, but care is taken not to harm, harass or otherwise disturb summer chum spawners.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

The supplementation program was initiated on Salmon Creek in 1992 and the reintroduction program was started on Chimacum Creek in 1996. Since initiation of the programs (1) the number of summer chum adults trapped, handled, collected on Salmon Creek for broodstock, and/or released upstream has ranged from 100 to 1000 fish each year; (2) the number of fry released has ranged from 2,000 to 72,000 fish each year in Salmon Creek and has ranged from 28,000 to 70,000 fish each year in Chimacum Creek; and (3) the mortality during the incubation and rearing stages has ranged from 1800 to 25,400 fish each year in Salmon Creek and has ranged from 4000 to 22,000 fish each year in Chimacum Creek. Except for a 57% loss of eggs/fry during 1992 (the first year of the program), a 92% loss of eggs/fry due to equipment failure in the Salmon Creek Hatchery during 1994 (which was corrected in 1995) and a 42% loss of eggs/fry during 1996 (the first year of the reintroduction program) in the Chimacum Creek Hatchery, the routine operation of the supplementation and reintroduction program has resulted in egg-to-fry release survivals of 87% to 98%.

- Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).

Projected annual take levels are (1) 18,450 eggs or fry mortality during incubation, rearing, and release (based on 141,500 eggs, 85% survival egg to release, and 123,000 fry release); (2) 240 adults removed for broodstock for Salmon Creek and Chimacum Creek combined (based on 240,350 eggs, 2500 eggs/female, 1.5 males/female); (3) unintentional lethal take of 30 adults during trapping, holding prior to spawning or release (based on 2% loss of 1500 adults trapped); (4) 1230 adults associated with trapping operation where fish are captured, handled and released upstream (based on 1500 adults trapped minus broodstock and unintentional lethal take); (5) 500 adults associated with disturbance of spawners during spawner surveys and carcass and mark recovery projects (based on multiple events and average of 1 occurrence/spawner for one-third of 1500 spawners); and (6) 300 carcasses sampled for otoliths, scales, Genetic Stock Identification, and other biological information during spawner surveys, broodstocking, and routine monitoring and evaluation activities (based on target sample size of 300). See Table 1.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.

The take will be limited since the number of broodstock collected will be consistent with guidelines and protocols in the SCSCI and the number of carcasses collected will be consistent with monitoring and evaluation objectives in the SCSCI. Methods to prevent catastrophic loss during incubation, rearing, and release are in compliance with program operations and protocols in the SCSCI (which includes measures to cull surplus production) and will limit take.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.
This program is fully consistent with the guidelines, protocols, and implementation of the co-manager's Summer Chum Salmon Conservation Initiative (SCSCI) (WDFW et al. 2000).

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates.

This HGMP is consistent with relevant standing orders and agreements. The Puget Sound Salmon Management Plan (PSSMP)is a federal court order that currently controls both the harvest management rules and production schedules for salmon in Hood Canal under the *U.S. v. Washington* management framework. The parties to the SCSCI recognize that it may be necessary to modify these plans in order to implement the recommendations that will result from the SCSCI. However, the provisions of the PSSMP will remain in effect until modified through court order by mutual agreement

3.3) Relationship to harvest objectives.

The summer chum supplementation program is integrated with fisheries management measures as defined in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000). The "base conservation" fishery total harvest rate proposed under the Summer Chum Salmon Conservation Initiative is 10.8% (with a range of 3.3% to 15.3%). These rates reflect incidental fishery harvest levels in Canadian and U.S. fisheries. Actual harvest rates on summer chum produced in

eastern Strait of Juan de Fuca watersheds should be lower, due to the lack of terminal area commercial fisheries directed at other species where summer chum may be incidentally taken.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

No directed fisheries on summer chum salmon result from adult fish produced through the Salmon Creek or Chimacum Creek programs. As noted in 3.3, above, the "base conservation" fishery total harvest rate proposed under the Summer Chum Salmon Conservation Initiative is 10.8% (with a range of 3.3% to 15.3%), but should be lower for the Salmon/Snow Creek stock. These rates reflect incidental fishery harvest levels in Canadian and U.S. fisheries. Exploitation rates on the Salmon/Snow stock have been 8.7%, 10.6%, 51.2%, 35.5%, 27.2%, 23.2%, 11.0%, 16.8%, 4.8%, 2.0%, 2.4%, and 2.6% for the years 1987 through 1998, respectively (WDFW et al. 2000).

3.4) Relationship to habitat protection and recovery strategies.

The summer chum supplementation program is integrated with habitat restoration and management measures as defined in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000). The SCSCI provides a standardized approach to determine freshwater and estuarine limiting factors in each summer chum watershed. Habitat factors for decline and recovery for each watershed are described. In addition, at the ESU scale, protection and restoration strategies for each limiting factor for decline are provided. The goalof the habitat protections and restoration strategy is to maintain and recover the full array of watershed and estuarine-nearshore processes critical to the survival of summer chum across all life stages.

3.5) Ecological interactions.

Chum salmon have an unique relationship with other salmonid species that will generally benefit the other species. In most circumstances, because of their small size and relative abundance at out-migration, summer chum fry have a positive impact as prey for other salmonids, including chinook salmon, coho salmon, and coastal cutthroat trout. In turn, chinook and coho salmon and coastal cutthroat could negatively impact the summer chum supplementation program via predation on summer chum fry, but the risk of significant impact is likely low. Chum have not been identified as predators on other salmonids and have a low risk of negatively impacting salmonids as predators.

The supplementation program will result in an increase in the number of chum salmon carcasses in freshwater areas and provide a source of nutrients which will

benefit other salmonids and non-salmonids.

Supplemented summer chum may compete for food with wild chum fry. This risk will be minimized through the release of supplemented fish at a larger size than the wild fry which should lead to niche separation in the two groups.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

Summer chum adults are trapped and held in Salmon Creek for spawning and no water is removed from the creek during broodstock collection or holding. Eggs taken from summer chum adults trapped in Salmon Creek are incubated to the eyed stage at the WDFW Dungeness Hatchery. Water rights at the Dungeness facility allow for the withdrawal of up to 15 cfs of surface water from intakes in the Dungeness River. After eye-up, the eggs are transferred to an incubation and initial rearing facility located on Houck Creek, a tributary to Salmon Creek at approximately RM 2.5. The Salmon Creek Hatchery uses a small volume of gravity-fed water to incubate and rear fish (9 gpm for incubation during November through March; 40 gpm for rearing during March and April), drawn through an intake structure positioned in a 1/4 acre pond supplied by Houck Creek, and above a natural barrier to fish migration. The water is returned directly to the tributary near the withdrawal point. The summer chum fry are transferred to net-pens in Discovery Bay for rearing to release size in estuarine waters near the mouth of Salmon Creek.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

Dungeness and Salmon Creek hatchery withdrawal methods (wells, screened intakes) will not lead to injury or mortality to listed fish because the intake structures are located above natural barriers to fish migration (Salmon Creek) or are supplied by infiltration and are adequately screened to minimize risk to listed fish (Dungeness). The Dungeness Hatchery operates under a standing NPDES permit that limits discharge effects on the environment, and requires monitoring of effluent for settleable and suspended solids. The Salmon Creek Hatchery and associated net-pens produce a relatively small amount of fish each year, and well under the 20,000 pounds per year criteria set by WDOE as the limit for concern regarding hatchery effluent discharge effects and for the requirement for an NPDES permit. The NPDES permit and low production levels will likely lead to no adverse effects on water quality from the program on listed fish.

SECTION 5. FACILITIES

5.1) Broodstock collection facilities (or methods).

Broodstock are collected for the program using a weir and permanent trap positioned in Salmon Creek at approximately RM 0.2. During 1992-1999, the weir was constructed of metal grating near the trap box, and metal posts and fencing material on the right bank side of the trap box. The trap box consists of a concrete structure framed by 2"x 2" pickets on the upstream end, and metal grating on the downstream end. Fish are contained in the 6' x 10' trap area through a "V" weir. During summer 2000, the weir and trap will be removed as part of a habitat recovery project designed to enhance summer chum freshwater survival. Beginning in 2000, the weir will be replaced with a temporary weir of similar dimensions constructed of wood slats and fencing materials; and the trap will be of similar dimensions with a natural gravel bottom. Captured fish are held in the box until their daily removal for spawning or passage upstream. Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath a temporary awning to protect the eggs and milt collected from the fish from rain. Eggs and milt are transported chilled in plastic bags and buckets by truck to Dungeness Hatchery for fertilization and loading into incubators.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Eggs and milt are transported chilled in plastic bags by truck from Salmon Creek to Dungeness Hatchery. Eyed eggs are transported moist to Salmon Creek Hatchery by truck in 5 gallon buckets cushioned by foam pads. Fed fry are transported to saltwater net pens by truck in a 4' x 4' x 2.5' plastic fish tote aerated with regulated oxygen from an oxygen bottle via air stone.

5.3) Broodstock holding and spawning facilities.

Broodstock are held in the broodstock collection trap described in 5.1, above, for about 1-2 days prior to scheduled spawning days (usually twice a week). On other days, the broodstock collection trap is checked daily and fish are passed upstream. Fish are spawned directly adjacent to the trap. Spawning is accomplished as needed beneath a temporary awning to protect the eggs and milt collected from the fish from rain.

5.4) Incubation facilities.

Green and eyed eggs are incubated in vertical stack incubators at Dungeness Hatchery and the Salmon Creek Hatchery facility.

5.5) Rearing facilities.

Swim-up fry at Salmon Creek are initially reared in 8' x 2' x 1' fiberglass raceways. The fry are later transferred via truck to Discovery Bay, where the fish are transferred into one of two 10' x 20' floating net-pen structures supporting 8' deep, 1/8" stretch mesh containment nets (Wild Olympic Salmon 1999)

5.6) Acclimation/release facilities.

At the appropriate fish size and time, the summer chum are released directly into Discovery Bay by lowering and inverting the net-pen.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

During rearing of Brood Year 1994, the water intake was buried by sediment during a major storm event which cut off the water supply and resulted in the catastrophic loss of about 23,000 of 25,000 alevin on-hand. Risk aversion measures described in 5.8, below, were implemented beginning with brood year 1995 and there has been no recurrence of difficulties.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

The hatchery at Salmon Creek is supplied by water that is gravity-fed from an adjacent pond. Incubating and rearing eggs and fry will therefore not be affected by power failures.

The water intake was redesigned in 1995 and has functioned without difficulty through several major storm events. It consists of a 2'x2'x3' screen box of slotted aluminum bolted to a concrete slab and further anchored with rip rap. The buried 4-inch PVC pipe enters the box 1foot below the average height of the pond surface. As the pond water level rises the surface area of the intake increases. The intake unit is 7 feet from the pond bank. A walkway extends to the intake to allow for regular brooming of it's surfaces. The walkway also supports a 4' x8' groin (wall) that is designed to deflect sediments during extreme high water flows.

The Salmon Creek hatchery is not staffed full time, but is checked at least once

daily during operation and two or more times a day during high flows and/or severe cold weather events. The facility is armed with a battery powered, cell phone activated, alarm system. A security company provides 24 hour computerized monitoring and their personnel immediately contact the list of crew members to respond to both low water flow and low battery signals. Two of the seven crew members live within 15 minutes driving time from the site, five are within 30 minutes driving time. Three crew members carry pagers. The back up water supply is triggered simultaneous to the alarm signal. A battery powered bilge pump is housed within a concrete box in the pond outflow stream. It supplies 5-7gpm flow via buried 2"PVC pipe for over an hour allowing for correction of a water supply problem or further emergency measures.

Saltwater net-pens used to finish rearing are supplied with water through tidal flow. This site is monitored by trained crew members one or more times a day.

Water used for incubation at Dungeness Hatchery is supplied by infiltration wells adjacent to the Dungeness River. The hatchery is supplied with an alarm system and back-up generator in the event of power failure, and is staffed full-time to allow rapid response to other factors, such as flooding, that could harm incubating eggs.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

Indigenous summer chum broodstock were first collected from Salmon Creek for the supplementation program in 1992. The project is now in its eighth year of operation, and the indigenous population, now of hatchery and natural lineage, continues to be used as broodstock.

6.2) Supporting information.

6.2.1) History.

The founding Salmon/Snow summer chum stock, which includes fish returning to Salmon Creek and Snow Creek, was designated as “depressed” in status by the Co-managers in the SCSCI (WDFW et al. 2000). As a supplementation effort, the program is designed to increase the numbers of summer chum returning to Salmon Creek, resulting in recovery of the population; and to provide progeny of Salmon Creek stock to reintroduce a summer chum population to Chimacum Creek. Prior to initiation of the supplementation program, the stock was rated as at high risk of extinction. However, based on an increasing escapement trend and recent large escapements attributable in large part to the success of the hatchery program, the current extinction risk for this stock is low (WDFW et al. 2000).

6.2.2) Annual size.

The number of broodstock collected is consistent with the guidelines in the SCSCI. The allowable broodstock collection number was initially set at 10 % of the total female summer chum return, to limit the effects of the removal of adult fish on abundance and diversity of the naturally spawning population. This limit was adjusted upward to 20 % of the total number of female summer chum returning to the watershed beginning in 1996. To achieve maximum release goals of 123,000 fed fry on Salmon Creek and 86,000 fed fry on Chimacum Creek, up to 240 adult summer chum (96 females and 144 males) will be collected. The use of broodstock in the supplementation program has already resulted in increased runsizes and natural escapements and changed the risk of extinction from "high" to "low" for this stock (WDFW et al. 2000).

6.2.3) Past and proposed level of natural fish in broodstock.

Only summer chum indigenous to the Snow/Salmon stock have been used as broodstock The project is now in its ninth year of operation, and the indigenous population, now of hatchery and natural lineage, continues to be used as broodstock.

6.2.4) Genetic or ecological differences.

The indigenous Snow/Salmon stock is the only source of broodstock. Hence, there are no known genotypic, phenotypic, or behavioral differences between the current supplementation stock and the natural stock, but it is being monitored.

6.2.5) Reasons for choosing.

It is the indigenous summer chum salmon stock. No special traits or characteristics were selected for in the broodstock within the indigenous stock

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

The risk of among population genetic diversity loss will be reduced by selecting the indigenous summer chum salmon population for use as broodstock in the supplementation program.. The broodstock are collected randomly in a manner representative of the timing and magnitude of the return to the creek. No more than 20% of the total number of female summer chum returning to the watershed will be used as broodstock.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults

7.2) Collection or sampling design.

Summer chum adults are captured within the August 1 and October 31 adult migration period each year. Fish not retained for use as broodstock are released upstream of the trap site to spawn naturally. The trap is checked at least daily for captured fish, and more frequently during freshets. If it is determined that there is a risk to fish life, the trap will be opened to allow free passage of fish through the trap. As mentioned previously, the allowable broodstock collection number was initially set at 10 % of the total female summer chum return, to limit the effects of the removal of adult fish on abundance and diversity of the naturally spawning population. This limit was adjusted upward to 20 % of the total number of female summer chum returning to the watershed beginning in 1996. Summer chum broodstock are collected randomly as the fish arrive at the trap location, proportional to the timing, weekly abundance, and duration of the total return to the creek. The weir and fish trap are located in the lower reaches of the watershed, near the most downstream point of observed natural spawning activity. Less than 10 % of the total summer chum return has been observed to spawn downstream of the trap (WOS 1999, 2000). Nearly the entire summer chum return to the creek is available for trapping, decreasing the risk that fish trapped through the program are not representative of the total run.

7.3) Identity.

Only one summer chum population is present. Otolith marking of fry and recovery of otoliths from adults will allow identification of hatchery and natural-origin fish.

7.4) Proposed number to be collected:

7.4.1) Program goal:

96 females plus 144 males for a total of 240 adults
(52 females plus 78 males for a total of 130 adults for Salmon Creek and
44 females plus 66 males for a total of 110 adults for Chimacum Creek)

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Year	Adults			Eggs	Juveniles
	Females	Males	Jacks		
1988					
1989					
1990					
1991					
1992	27	35			
1993	23	29			
1994	12	12			
1995	18	35			
1996	50	59			
1997	50	60			
1998	56	65			
1999	31	34			
2000	65	71			

Data source: SCSCI (WDFW et al. 2000) and WDFW files. (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

The production of surplus eggs or fish is avoided to the extent feasible by limiting the number of adult summer chum secured through broodstock collection operations. Summer chum adults trapped in excess of program goals will be passed upstream to spawn naturally. Any surplus production will be treated in accordance with protocols set forth in the Summer Chum Salmon Conservation Initiative (WDFW et al. 2000).

7.6) Fish transportation and holding methods.

None proposed.

7.7) Describe fish health maintenance and sanitation procedures applied.

Fish health monitoring associated with adult fish used in the program is conducted through the WDFW Fish Health Division. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the "Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998). Ovarian fluid, kidney, and spleen samples are collected from all fish spawned for evaluation by WDFW Fish Health Division staff for disease certification purposes.

7.8) Disposition of carcasses.

Returned to stream for nutrient enhancement.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines. The indigenous population is the broodstock source. The multi-trait distribution of the broodstock closely matches the multi-trait distribution of the target population (similar spawn timing, size, appearance, age structure, etc.). The broodstock collection is technically and logistically possible.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Summer chum broodstock are collected randomly as the fish arrive at the trap location, proportional to the timing, weekly abundance, and duration of the total return to the creek. The weir and fish trap are located in the lower reaches of the watershed, near the most downstream point of observed natural spawning activity. Less than 10 % of the total summer chum return has been observed to spawn downstream of the trap (WOS 1999). Nearly the entire summer chum annual return to the creek is available to trapping, decreasing the risk that fish trapped through the program are not representative of the total run.

8.2) Males.

Use of backup males is not an integral part of the program, but may occur as a precautionary measure. Jacks will be used proportional to their abundance in the total return to the creek.

8.3) Fertilization.

Summer chum adults collected at the Salmon Creek weir are spawned adjacent to the weir site. Eggs and milt collected from spawned fish are placed separately in dry, zip-locked bags, and chilled for transport by truck to Dungeness Hatchery (WOS 1999). Eggs will be fertilized at Dungeness Hatchery factorially, or using at least a 1:1 spawning ratio. Spawning protocols are done in accordance with the Co-Managers Fish Health Policy.

8.4) Cryopreserved gametes.

None used.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

1:1 individual matings or a factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the summer chum salmon population that is the subject of this supplementation program.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Consistent with the SCSCI, the following survival rate objectives for each life stage will be applied to all programs; these rates will be used as criteria for measuring the effectiveness of each program.:

Chum Life Stage	% Survival by Life Stage	Cum. % Survival from Green Egg
Green egg to eye-up	90.0 %	90.0 %
Eye-up to Swim-up	99.5 %	89.5 %
Swim-up to release	95.0 %	85.0 %

The following data on number of eggs and fry and survival rates by life stage for summer chum reared at Salmon Creek Hatchery is from Wild Olympic Salmon annual reports (WOS 1999, 2000) and WDFW files as summarized in Thom H. Johnson, WDFW memo dated November 1, 2000:

	Number of eggs or fry					% Survival by life stage		
	Total 1/		Salmon Creek Hatchery			Salmon Creek Hatchery		
Brood year	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release
1992	46,980	44,280	44,280	18,684	19,200	94.3%	42.2%	100%
1993	----	46,300	46,300	----	44,000	----	----	----
1994	----	24,200	24,200	2,000	2,000	----	8.3%	100.0%
1995	41,750	39,200	39,200	38,808	38,808	93.9%	99.0%	100.0%
1996	----	114,900	64,900	62,300	62,000	----	96.0%	99.5%
1997	133,340	112,900	72,900	71,011	71,821	84.7%	97.4%	100%
1998	164,300	149,100	69,100	68,423	67,807	90.7%	99.0%	99.1%
1999	87,350	78,300	29,200	28,950	28,400 2/	89.6%	99.1%	98.1%

1/ total includes eggs taken for Salmon Creek supplementation and Chimacum Creek reintroduction programs
2/ does not include 6300 fish transferred on June 1 at 256 fpp from Dungeness Hatchery and 6280 fish released at R.M. 0.1 in Salmon Creek on June 12 at 175 fpp after rearing in freshwater there; total release was 34,680 fish for BY 1999.

9.1.2) Cause for, and disposition of surplus egg takes.

None anticipated. Any surplus production will be handled consistent with protocols in the SCSCI.

9.1.3) Loading densities applied during incubation.

After fertilization, the eggs are placed in vertical stack incubators for incubation to the eyed egg stage. All eggs receive an otolith thermal mark at Dungeness during incubation. The eggs are shocked at eye-up, enumerated and transferred to Salmon Creek for incubation through hatch in vertical stack incubators. The eyed eggs are incubated at a density of 5,000-9,000 per tray, with each vertical stack supplied with flow at a rate of 3 gpm.

9.1.4) Incubation conditions.

There is low or no siltation risk due to high quality well water source at Dungeness Hatchery and due to the Houck Creek source and settling basin at Salmon Creek Hatchery.

At Salmon Creek Hatchery, eggs are checked at eye-up and protected during tender stage (maintained in darkness, avoid disturbance, etc). Temperature regimes and dissolved oxygen levels have posed no problems during operation of facilities. Influent and effluent DO readings exceed 10mg/L throughout incubation

phase. Fish are incubated at ambient water temperatures. When water temperatures near 32 degrees F., an in-line propane fired heating unit is used to raise the water temperature enough to prevent freeze up. Temperature units (TUs) are monitored. 24 hour average temperatures are generally from 38 to 44 degrees F. during incubation.

9.1.5) Ponding.

Fry from each egg take remain in incubators until 75% of fry are fully buttoned up at which time forced ponding occurs. Average weight at this time is about 1,250fpp.

Brood	Eye-up		Ponding	
year	Dates	TU (F)	Dates	TU (F)
1992	11/6	Not avail.	volitional,1/22-5/2	Not available
1993	10/28-11/5	750-758	volitional,1/22-4/2	1658-2185
1994	11/1	570	volitional,1/10-2/9	1089-1403
1995	11/2-12/5	576-735	forced, 1/12-3/3	1294-1566
1996	11/2-1/13	700-807	forced, 2/3-3/25	1283-1536
1997	11/10-12/19	614-811	forced, 2/4-3/18	1540-1595
1998	11/16-12/21	684-729	forced, 2/9-3/26	1409-1541
1999	11/15-12/20	726-793	forced, 2/27-3/23	1520-1632

9.1.6) Fish health maintenance and monitoring.

All summer chum are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998). All eggs transferred from Salmon Creek for fertilization at Dungeness Hatchery are water hardened in an iodophore solution. Fungus in incubators is controlled by formalin drip prior to eye-up. Eggs are shocked at eye-up to remove mortalities.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.

Eggs will be incubated using high quality water to minimize the risk of catastrophic loss due to siltation. All summer chum are incubated under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998); see 9.1.6 above.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available..

Source: Thom H. Johnson, WDFW, memo dated November 3, 2000.

	Number of eggs or fry						% Survival by life stage		
	Total 1/		Salmon Creek Hatchery				Salmon Creek Hatchery		
Brood year	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released		Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release
1992	46,980	44,280	44,280	18,684	19,200		94.3%	42.2%	100%
1993	----	46,300	46,300	----	44,000		----	----	----
1994	----	24,200	24,200	2,000	2,000		----	8.3%	100.0%
1995	41,750	39,200	39,200	38,808	38,808		93.9%	99.0%	100.0%
1996	----	114,900	64,900	62,300	62,000		----	96.0%	99.5%
1997	133,340	112,900	72,900	71,011	71,821		84.7%	97.4%	100%
1998	164,300	149,100	69,100	68,423	67,807		90.7%	99.0%	99.1%
1999	87,350	78,300	29,200	28,950	28,400	2/	89.6%	99.1%	98.1%

1/ total includes eggs taken for Salmon Creek supplementation and Chimacum Creek reintroduction programs
2/ does not include 6300 fish transferred on June 1 at 256 fpp from Dungeness Hatchery and 6280 fish released at R.M. 0.1 in Salmon Creek on June 12 at 175 fpp after rearing in freshwater there; total release was 34,680 fish for BY 1999.

9.2.2) Density and loading criteria (goals and actual levels).

Hatchery rearing densities will be those that yield the highest expected survivals. The following conservative "standard" and "maximum" pond loading densities will be applied in all proposed supplementation programs to promote the release of healthy, viable fish, as reported in the SCSCI:

	Pounds fish/gpm inflow		**Pounds fish/ft3 rearing volume**	
Chum size	Standard	Max.	Standard	Max.
Swim-up	<1.0	1.5	0.5	0.75
1200-600/lb	1.0	2.5	1.0	2.0
600-400/lb	1.5	3.0	1.0	2.0

Actual loading rates at Salmon Creek Hatchery are consistent with the SCSCI guidelines.

At Salmon Creek Hatchery, freshwater rearing vessels are loaded up to a maximum of 10,000 fish each with flows maintained at approximately 10gpm per vessel. Loading rates are typically < 1.0 pounds of fish per gpm inflow. Fish are transferred to two 10' x 20' x 8' saltwater net pens at about 1000 fpp where densities are < 0.2 pounds fish/ft3 rearing volume.

9.2.3) Fish rearing conditions

Fry are removed from incubators and ponded into raceways at Salmon Creek Hatchery upon absorption of the yolk sac. Lots are segregated during rearing by egg take date. Temperature regimes and dissolved oxygen levels have posed no problems during operation of facilities.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.
Biweekly weights, measuring fish per pound (fpp), are taken for pooled egg takes.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.
Not collected, applicable, nor available. Fry are released at 1.0 gram average size to ensure that fry have sufficient energy reserves.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).
One to three days after ponding, feed is introduced to the fry via hand casting and 12-hour automatic spring driven belt feeders. Biomoist #3 feed at the rate of 2.5% per body weight per day(% BW/day) or EWOS feed at 2.0% BW/day is used during the fresh water phase. Within 1 to 2 weeks of ponding, after the fish have established feeding behavior, they are transferred to the saltwater net-pens in Discovery Bay at a size of about 1000 fpp. After transfer to saltwater, the feeding rate is increased to 5% BW/day. Hand casting of feed over the net-pens water surface is done at least once a day to ensure all fish have exposure to feed. Sample weights to identify fish size and appropriate feeding rates are taken every one to two weeks during the net-pen rearing period.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.
All summer chum are reared under the guidance of certified fish health personnel from WDFW and in accordance with the Co-Manager's Fish Health Policy (WDFW and WWTIT 1998). Fish are monitored daily during rearing for sign of disease, through observation of feeding and swimming behavior and monitoring of daily mortality trends. Preferred and maximum pond loading and feeding parameters are adhered to at all times, as specified in the SCSCI (WDFW et al. 2000). Fish reared in the salt water net-pens have experienced mortalities due to vibrosis and affected fish have been released after confirmation of disease by fish health personnel. Fish have been treated prophylactically by feeding medicated feed, and net-pen management strategies, including reduction in feeding levels, and reduction of fish densities through early fish releases. As of the 1998 brood year, all fry are to be inoculated with a vibrio vaccine dip prior to transfer to

saltwater. Each year summer chum fry in the net-pens are examined by a fish pathologist within three weeks prior to release to determine fish health status.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.
Not applicable.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.
Saltwater net-pens are used early in the development of fry, getting chum to seawater which is a natural life history strategy. Marine water flowing through the pens provides natural food.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.
The hatchery at Salmon Creek is supplied by water that is gravity-fed from an adjacent pond. Incubating and rearing eggs and fry will therefore not be affected by power failures. The hatchery is equipped with a low flow alarm which is monitored by a professional security company. There are multiple crew members available to respond to an alarm, several carry pagers. The alarm system operates using a cellular phone system making it more reliable during storm events. The back-up system is battery operated, also making it more reliable during storm events. The system signals for low battery, and although it has demonstrated to operate over 2 weeks without recharging, batteries are changed and recharged weekly. The same circuit that activates an alarm triggers the battery powered pump for the backup water source. These batteries are changed and recharged whenever the pump has been activated to maintain maximum power in the event of a true emergency. The facility is not staffed full time, but the operation is checked at least once daily during operation and more often during high flows and/or extreme cold weather events. Net-pens used to finish rearing are supplied with water through tidal flow. Uniform rearing methods are applied across egg take groups. Fry are reared for 30 to 45 days which limits risk of domestication.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.

10.1) Proposed fish release levels.

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry	123,000	300-450	March - May	Discovery Bay
Fingerling				
Yearling				

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: Salmon Creek, WRIA 17.0245

Release point: Discovery Bay, from netpens located 1 mile from mouth of Salmon Creek and < 1/3 mile from Salmon Creek tidal channel

Major watershed: Discovery Bay

Basin or Region: Strait of Juan de Fuca

10.3) Actual numbers and sizes of fish released by age class through the program.

After 30 to 60 days of rearing in the net-pens, and upon reaching an individual size of 1.0 - 1.5 grams, the summer chum are released into Discovery Bay.

Release year	Eggs/ Unfed Fry	Avg size	Fry	Avg size	Fingerling	Avg size	Yearling	Avg size
1988								
1989								
1990								
1991								
1992								
1993			19,200	1.1 g				
1994			44,000	1.8 g				
1995			2,000	1.3 g				
1996			38,808	1.3 g				
1997			62,000	1.3 g				
1998			71,821	1.3 g				
1999			67,832	1.3 g				
2000			34,680	1.3 g				
Average			42,543	1.3 g				

Data source: SCSCI (WDFW et al. 2000) and WDFW files. (Link to appended Excel spreadsheet using this structure. Include hyperlink to main database)

10.4) Actual dates of release and description of release protocols.

Released from saltwater netpens to mimic natural migrational characteristics for life stage at release; forced release; no culling. Released by lowering and inverting pen during natural emigration period.

Release dates: 1995: April 1; 1996: April 24; 1997: April 8, April 24; 1998: March 31, April 16; 1999: March 31, April 21, May 4; 2000: April 23, June 12..

10.5) Fish transportation procedures, if applicable.

Prior to final rearing and release, fed fry are transported in ambient temperature freshwater to saltwater net pens in a 4' x 4' x 2.5' plastic tote aerated with regulated oxygen via air stone; transport takes < 60 minutes.

10.6) Acclimation procedures

Direct release from saltwater netpens.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

100% otolith-marked.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

None anticipated. Any surplus production will be handled consistent with protocols in the SCSCI.

10.9) Fish health certification procedures applied pre-release.

Examination by WDFW fish pathologist prior to release.

10.10) Emergency release procedures in response to flooding or water system failure.

If fish are at the eyed egg and/or alevin stage, regulated oxygen can be administered directly into the clarifier barrel. If fish are developed to the fry stage and have been ponded, a transport tote and regulated oxygen are available for immediate transport of the fish to the release site or saltwater netpens.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

The fry are released in the evening, on a high tide, to minimize the incidence of avian and fish predation. Fed fry are released that will maximize survival, and minimize the risk of interaction with wild summer chum fry that adhere to nearshore waters during the time of 1.0 gram chum fry release.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

It is planned that all "Performance Indicators" identified in Section 1.10 will be monitored and evaluated.

To date, the following "Performance Indicators" **addressing benefits** have monitored for the Salmon Creek summer chum supplementation program:

Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.

1. Differentially mark all hatchery-origin summer chum fry to allow for distinction from natural-origin fish upon return as adults on the spawning grounds. This will be accomplished by otolith (thermal) marking or another permanent, effective method.
2. Conduct spawning ground surveys throughout the summer chum return to enumerate spawners, and to collect information regarding fish origin (via random sampling of fish heads for otoliths), and age class composition through scale sampling.
3. Estimate the number of naturally spawning hatchery-origin summer chum contributing to each supplemented population's annual escapement.

Element 4: Collect and evaluate information on adult returns.

1. Commencing with the first year of returns of progeny from naturally-spawned, hatchery-origin summer chum, evaluate results of spawning ground surveys and age class data collections to:
   a. Estimate the abundance and trends in abundance of spawners;
   b. Estimate the proportion of the escapement comprised by chum of hatchery lineage, and of wild lineage;
   c. Through mark sampling, estimate brood year contribution for hatchery lineage and wild-origin fish.

Using the above information, determine whether the population has declined, remained stable, or has been recovered to sustainable levels. The ability to estimate hatchery and wild proportions will be determined by implementation plans, budgets, and assessment priorities.

To date, the following "Performance Indicators" **addressing risks** have monitored for the Salmon Creek summer chum supplementation program:

Element 1: Estimate the contribution of supplementation/reintroduction program-origin chum to the natural population during the recovery process.

1. Monitor escapements of non-supplemented populations to determine the level of straying of supplementation program-origin fish to other drainages; e.g. Snow Creek.

Element 2: Monitor and evaluate any changes in the genetic, phenotypic, or ecological characteristics of the populations presently affected by the supplementation program.

1. Collect additional GSI data (allozyme or DNA-based) from regional summer chum adult populations to determine the degree to which discrete populations exist in the individual watersheds.
2. Continue GSI allozyme collections of summer chum spawners throughout the region for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the supplementation program has negatively affected the genetic diversity of natural populations.
4. Continue collecting and archiving DNA samples for future analysis.

Element 3: Determine the need, and methods, for improvement of supplementation or reintroduction operations or, if warranted, the need to discontinue the program.

1. Determine the pre-spawning and green egg to released fry survivals for each program at various life stages.
   e. Monitor growth and feed conversion for summer chum fry.
   f. Determine green egg to eyed egg, eyed egg to swim-up fry, and swim-up fry to released fry survival rates for summer chum.
   g. Maintain and compile records of cultural techniques used for each life stage, such as: collection and handling procedures, and trap holding durations, for chum broodstock; fish and egg condition at time of spawning; fertilization procedures, incubation methods/densities, temperature unit records by developmental stage, shocking methods, and fungus treatment methods for eggs; ponding methods, start feeding methods, rearing/pond loading densities, feeding schedules and rates for juveniles; and release methods for fed fry.
   h. Summarize results of tasks for presentation in annual reports.
   i. Identify where the supplementation program is falling short of objectives, and make recommendations for improved fry production as needed.
2. Determine if broodstock procurement methods are collecting the required number of adults that represent the demographics of the donor population with minimal injuries and stress to the fish.
   a. Monitor operation of adult trapping operations, ensuring compliance with established broodstock collection protocols for each station.
   b. Monitor timing, duration, composition, and magnitude of each run at each adult collection site.
   c. Maintain daily records of trap operation and maintenance, number and condition of fish trapped

d. Collect biological information on collection-related mortalities. Determine causes of mortality, and use carcasses for stock profile sampling, if possible.

e. Summarize results for presentation in annual reports. Provide recommendations on means to improve broodstock collection, and refine protocols if needed for application in subsequent seasons.

3. Monitor fish health, specifically as related to cultural practices that can be adapted to prevent fish health problems. Professional fish health specialists supplied by WDFW (or USFWS for federal agency operations) will monitor fish health.

a. Fish health monitoring will be conducted by a fish health specialist. Significant fish mortality to unknown causes will be sampled for histopathological study.

b. The incidence of viral pathogens in summer chum broodstock will be determined by sampling fish at spawning in accordance with procedures set forth in the "Co-Managers of Washington Fish Health Policy (WDFW and WWTIT 1998).

c. Recommendations on fish cultural practices will be provided on a monthly basis, based upon the fish health condition of chum fry.

d. Fish health monitoring results will be summarized in an annual report.

Element 4: Collect and evaluate information on adult returns.

This element will be addressed through consideration of the results of previous "Elements 1., 2., and 3.", and through the collection of information required under adaptive criteria that will be used as the basis for determining when to stop a supplementation or reintroduction program.

1. Collect age, sex, length, average egg size, and fecundity data from a representative sample of broodstock used in supplementation program for use as baseline data to document any phenotypic changes in the populations.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

Funding, staffing, and support are available and committed for current Monitoring and Evaluation. Additional funds may be needed to support allozyme, DNA and otolith analysis.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

It is anticipated that adherence to monitoring and evaluation protocols in the SCSCI will not elevate risk to listed summer chum. Listed chinook salmon are not present in the Salmon Creek watershed and will not likely be affected by the program.

SECTION 12. RESEARCH

*Provide the following information for any research programs conducted in **direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish**. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in **Table 1**.*

Not applicable to this program. Research currently underway or planned for similar summer chum supplementation projects at Big Beef Creek and Quilcene National Fish Hatchery will provide valuable information regarding the effects and success of chum supplementation programs and be applicable here. Research may be proposed in the future at Salmon Creek.

12.1) Objective or purpose.
Not applicable

12.2) Cooperating and funding agencies.
Not applicable

12.3) Principle investigator or project supervisor and staff.
Not applicable

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.
Not applicable

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.
Not applicable

12.6) Dates or time period in which research activity occurs.
Not applicable

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.
Not applicable

12.8) Expected type and effects of take and potential for injury or mortality.
Not applicable

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1). Not applicable

12.10) Alternative methods to achieve project objectives.
Not applicable

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.
Not applicable

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
Not applicable

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

Attachments

WDFW memos dated November 1, 2000 and November 3, 2000.

Citations

Allendorf, F.W., D. Bayles, D.L. Bottom, K.P. Currens, C.A. Frissell, D. Hankin, J.A. Lichatowich, W. Nehlsen, P.C. Troter, and T.H. Williams. 1997. Prioritizing Pacific salmon stocks for conservation. Conservation Biology Vol. 11 No. 1 p. 140-152.

Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State Salmon and Steelhead Stock Inventory. Olympia. 212 p.

Washington Department of Fish and Wildlife. 1996. Fish health manual. Hatcheries Program, Fish Health Division, Washington Dept. of Fish and Wildlife, Olympia. 69 p.

Washington Department of Fish and Wildlife and Western Washington Treaty Indian Tribes. 1998. Co-managers of Washington fish health policy. Fish Health Division, Hatcheries Program. Washington Dept. of Fish and Wildlife, Olympia.

Washington Department of Fish and Wildlife and Point-No-Point Treaty Tribes. 2000. Summer Chum Salmon Conservation Initiative. Hood Canal and Strait of Juan de Fuca Region. Jim Ames, Chris Weller, Gary Graves, editors. Fish Program, Washington Department of Fish and Wildlife, Olympia.

Wild Olympic Salmon. 1999. Salmon Creek and Chimacum Creek summer chum salmon restoration projects. 1998-99 annual report. 7 pp. plus attachments.

Wild Olympic Salmon. 2000. Salmon Creek and Chimacum Creek summer chum salmon restoration projects. 1999-2000 annual report. 22 pp. plus attachments.

SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Thom H. Johnson, WDFW, District Fish Biologist

Certified by_____ Date: February 28, 2000

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Fish Program - Region 6
Hood Canal District , 283236 Highway 101, Port Townsend, WA 98368
Phone (360) 765-3979 FAX (360) 765-4455 e-mail JOHNSTHJ@dfw.wa.gov

November 1, 2000

TO: Summer Chum Supplementation Workgroup: Jim Ames, WDFW; Tom Kane, USFWS, Chris Weller, PNPTC;
Ginna Correa, WDFW; Tom Ammeter, Paula Mackrow, North Olympic Salmon Coalition; Jim Hackman, Wild Olympic Salmon

FROM: Thom H. Johnson

SUBJECT: **Survival Rates by Life Stage for Summer Chum Salmon Reared in the Supplementation Program at Salmon Creek and the Reintroduction Program at Chimacum Creek**

The Summer Chum Salmon Conservation Initiative (SCSCI) and the Hatchery and Genetic Management Plans (HGMPs) prepared for the Salmon Creek and Chimacum Creek programs establish survival rate objectives during incubation and rearing.

The following survival rate objectives for each life stage are applied to all programs; these rates are used as criteria for measuring the effectiveness of each program:

Chum Life Stage	% Survival by Life Stage	Cum. % Survival from Green Egg
Green egg to eye-up	90.0 %	90.0 %
Eye-up to Swim-up	99.5 %	89.5 %
Swim-up to release	95.0 %	85.0 %

The Salmon Creek and Chimacum Creek summer chum programs have generally been successful in meeting the survival rate objectives. The number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum reared in the supplementation program at Salmon Creek Hatchery from 1992 through 1999 and in the reintroduction program at Chimacum Creek Hatchery from 1996 through 1999 are presented Table 1 and Table 2, respectively.

cc: Tim Flint, WDFW
Travis Nelson, WDFW
Jeffrey Haymes, WDFW
Jeff Grimm
Steve Schroder, WDFW
Cheri Scalf, WDFW
Tim Tynan, NMFS
Derek Poon, NMFS

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Table 1. Number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum salmon reared in the supplementation program at Salmon Creek Hatchery, 1992 through 1999 brood years.

	Number of eggs or fry					% Survival by life stage			Cumulative % survival		
	Total a/		Salmon Creek Hatchery			Salmon Creek Hatchery			Salmon Creek Hatchery		
Brood year	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release	Green egg to swim-up	Green egg to release	Eyed egg to release
1992	46,980	44,280	44,280	18,684	19,200	94.3%	42.2%	100.0%	39.8%	39.8%	43.4%
1993	----	46,300	46,300	26,837	44,000	----	58.0%	100.0%	----	----	95.0%
1994	----	24,200	24,200	2,000	2,000	----	8.3%	100.0%	----	----	8.3%
1995	41,750	39,200	39,200	38,808	38,808	93.9%	99.0%	100.0%	93.0%	93.0%	99.0%
1996	----	114,900	64,900	62,300	62,000	----	96.0%	99.5%	----	----	95.5%
1997	133,340	112,900	72,900	71,011	71,821	84.7%	97.4%	100.0%	82.5%	82.5%	98.5%
1998	164,300	149,100	69,100	68,423	67,807	90.7%	99.0%	99.1%	89.9%	89.1%	98.1%
1999	87,350	78,300	29,200	28,950	28,400 b/	89.6%	99.1%	98.1%	88.9%	87.2%	97.3%

a/ Total includes eggs taken for both Salmon Cr. supplementation and Chimacum Cr. reintroduction programs; all green eggs are incubated at Dungeness Hatchery and shipped as eyed eggs to Salmon Cr. Hatchery and Chimacum Cr. Hatchery

b/ Does not include 6300 fish transferred on June 1 at 256 fpp from Dungeness H. and 6280 fish released on June 12 at 175 fpp at R.M. 0.1 in Salmon Creek after rearing in freshwater there; total release was 34,680 fish for BY 1999.

Table 2. Number of eggs, swim-up fry, and fry released and the survival rates by life stage for summer chum salmon reared in the reintroduction program at Chimacum Creek Hatchery, 1996 through 1999 brood years.

	Number of eggs or fry					% Survival by life stage			Cumulative % survival		
	Total a/		Chimacum Creek Hatchery			Chimacum Creek Hatchery			Chimacum Creek Hatchery		
Brood year	Green eggs	Eyed eggs	Eyed eggs	Swim-up fry	Fry released	Green egg to eyed egg	Eyed egg to swim-up	Swim-up to release	Green egg to swim-up	Green egg to release	Eyed egg to release
1996	----	114,900	50,000	31,243	28,788	----	62.5%	92.1%	----	----	57.6%
1997	133,340	112,900	40,000	38,000	36,840	84.7%	95.0%	96.9%	80.4%	78.0%	92.1%
1998	164,300	149,100	80,000	73,750	70,050	90.7%	92.2%	95.0%	83.7%	79.5%	87.6%
1999	87,350	78,300	41,300	40,880	39,170	89.6%	99.0%	95.8%	88.7%	85.0%	94.8%

a/ Total includes eggs taken for both Salmon Cr. supplementation and Chimacum Cr. reintroduction programs; all green eggs are incubated at Dungeness Hatchery and shipped as eyed eggs to Salmon Cr. Hatchery and Chimacum Cr. Hatchery

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Fish Program - Region 6
Hood Canal District , 283236 Highway 101, Port Townsend, WA 98368
Phone (360) 765-3979 FAX (360) 765-4455 e-mail JOHNSTHJ@dfw.wa.gov

November 3,2000

TO: Summer Chum Supplementation Workgroup: Jim Ames, WDFW; Tom Kane, USFWS, Chris Weller, PNPTC;
Tom Ammeter, Paula Mackrow, North Olympic Salmon Coalition;
Jim Hackman, Wild Olympic Salmon

FROM: Thom H. Johnson and Ginna Correa

SUBJECT: **Summer Chum Salmon Otolith Mark Analysis, 1999**

Grimm et al. (2000) of WDFW's Fish Program Otolith Laboratory presents the results of otolith examination from adult summer chum salmon collected in Salmon, Snow, Jimmycomelately creeks and Little Quilcene River during 1999. Of the 173 otoliths read from adults sampled in Salmon Creek, 75% of age 3 adults and 73% of age 4 adults were otolith marked. Of two adults sampled in Snow Creek, one was otolith marked. In Jimmycomelately Creek, none of 6 adults sampled were otolith marked. In a sample of 34 adults from the Little Quilcene River, 5 age 3 adults and one age 4 adult were otolith marked with marks applied at Salmon Creek (Table 2). This indicates that some level of straying of Salmon Creek supplementation program adults has occurred into Snow Creek and Little Quilcene River.

I also present here estimated returns from fry to adult for summer chum salmon reared in the supplementation program at Salmon Creek. This is based on the total return of adult summer chum to Salmon Creek in 1999, the age composition of adults during 1999, the proportion of age 2, 3, and 4 adults otolith marked, and the number of fry released from the supplementation program during 1995, 1996, and 1997. I estimate return rates of 0.35% to age 3 and 0.38% to age 4 for brood years 1996 and 1995, respectively (Table 1).

Table 3 presents the mean fork length, age composition, and sex ratio for adult summer chum sampled in Salmon Creek during 1999.

We now have data from several years and estimates of the return from fry to adult for summer chum reared in the supplementation program at Salmon Creek are presented in Table 4 for the 1997, 1998, and 1999 return years and in Table 5 for the 1994, 1995, and 1996 brood years. For example, during the 1998 return year, a total of 528 otolith-marked adults from the supplementation program returned to Salmon Creek (Table 4). And, the 38,800 fry released from the brood year 1995 supplementation program contributed 13 age 2 adults in 1997, 471 age 3 adults in 1998, and 148 age 4 adults in 1999; this is a total contribution of 632 adults and a 1.63% survival rate from fry to adult (Table 5). It is important to note that the otolith marks were assessed by Jeff Grimm of the WDFW Otolith Lab as "difficult to recognize" (and differed only slightly from the natural otolith patterns of wild specimens) for the 1993 and 1994 brood years. Thus, the number, percentage and return rate for age 3 adults in 1997 and age 4 adults in 1998 produced from the supplementation program are possibly underestimated in Tables 4 and 5.

Jeffrey J. Grimm, Dana J. Anderson, Lang C. Nguyen, and Eric C. Volk. 2000. Otolith examination of Little Quilcene, Salmon, Snow, and Jimmycomelately creeks' spawner specimens – 1999 adult summer chum collection. Washington Department of Fish and Wildlife. Fish Program - Otolith Laboratory. 11 p.

Attachments: 3

cc: Tim Flint, WDFW
Travis Nelson, WDFW
Jeffrey Haymes, WDFW
Jeff Grimm, WDFW
Steve Schroder, WDFW
Cheri Scalf, WDFW
Tim Tynan, NMFS
Derek Poon, NMFS

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Table 1. Return from fry to adult for summer chum salmon reared in supplementation program at Salmon Creek as determined from otolith marks, 1999 return year.

								Supplementation program		
	Return	Total		Age comp. 2/	No. of	Otolith marks		Brood	No. of fry	Return rate
Stream	year	return	Age	(%)	adults	(%) 1/	No.	year	released	by age
Salmon Cr.	1999	499	2	0.0%	0	0.0%	0	1997	71,800	0.00%
			3	58.2%	290	75.2%	219	1996	62,000	0.35%
			4	40.7%	203	72.9%	148	1995	38,800	0.38%
			5	1.1%	6	0.0%	0	1994	2,000	0.00%

1/ From Table 2.
2/ From Table 3.

Table 2. Summary of otoliths examined for marks from adult summer chum salmon sampled at Salmon, Snow, and Jimmycomelately (JCL) creeks and Little Quilcene River, 1999.

Stream	Return year	Age	No. of otoliths examined	No. of otolith marks observed	Otolith marks (%)
Salmon Cr.	1999	2	0	0	0.0%
		3	101	76	75.2%
		4	70	51	72.9%
		5	2	0	0.0%
Snow Cr.	1999	2	0	0	0.0%
		3	1	0	0.0%
		4	1	1	100.0%
		5	0	0	0.0%
JCL Cr.	1999	2	0	0	0.0%
		3	0	0	0.0%
		4	6	0	0.0%
		5	0	0	0.0%
Little Quilcene R.	1999	2	0	0	0.0%
		3	22	5	22.7%
		4	12	1	8.3%
		5	0	0	0.0%

Table 3. Mean fork length (FL), age composition, and sex ratio for adult summer chum salmon sampled at Salmon Creek, 1999.

			Females sampled			Males sampled			Females + Males sampled		
	Return			Mean FL	Age comp.		Mean FL	Age comp.		Mean FL	Age comp.
Stream	year	Age	No.	(cm)	(%)	No.	(cm)	(%)	No.	(cm)	(%)
Salmon Cr.	1999	2	0	--	0.0%	0	--	0.0%	0	--	0.0%
		3	43	62	62.3%	60	64	55.6%	103	63	58.2%
		4	25	72	36.2%	47	73	43.5%	72	73	40.7%
		5	1	71	1.4%	1	74	0.9%	2	--	1.1%
		Total	69			108			177		

Table 4. Return from fry to adult for summer chum salmon reared in supplementation program at Salmon Creek, as determined from otolith marks for the 1997, 1998 and 1999 return years.

								Supplementation program		
				Age		Otolith marks			No. of	Return
Stream	Return year	Total return	Age	comp. (%)	No. of adults	(%)	No.	Brood year	fry released	rate by age
Salmon Cr.	1997	834	2	3.6%	30	44.4%	13	1995	38,800	0.03%
			3	64.3%	536	8.6%	46	1994	2,000	2.29%
			4	30.5%	255	2.7%	7	1993	44,000	0.02%
			5	1.6%	13	0.0%	0	---	---	---
						7.9%	66			
	1998	1134	2	0.7%	8	100.0%	8	1996	62,000	0.01%
			3	60.0%	680	69.2%	471	1995	38,800	1.21%
			4	39.3%	446	11.2%	50	1994	2,000	2.50%
			5	0.0%	0	0.0%	0	1993	44,000	0.00%
						46.6%	528			
	1999	499	2	0.0%	0	0.0%	0	1997	71,800	0.00%
			3	58.2%	290	75.2%	219	1996	62,000	0.35%
			4	40.7%	203	72.9%	148	1995	38,800	0.38%
			5	1.1%	6	0.0%	0	1994	2,000	0.00%
						75.7%	367			

Table 5. Return from fry to adult for summer chum salmon reared in supplementation program at Salmon Creek, as determined from otolith marks for the 1994, 1995 and 1996 brood years.

Stream	Brood year	No. of fry released	Return year	Age	No. of otolith-marked adults	Return rate by age
Salmon Cr.	1994	2,000	1996	2	--	--
			1997	3	46	2.30%
			1998	4	50	2.50%
			1999	5	0	0.00%
				Total	96	4.80%
	1995	38,800	1997	2	13	0.03%
			1998	3	471	1.21%
			1999	4	148	0.38%
			2000	5		
				Total	632	1.63%
	1996	62,000	1998	2	8	0.01%
			1999	3	219	0.35%
			2000	4		
			2001	5		
				Total	227	0.37%

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: Summer chum salmon ESU/Population: Hood Canal Summer Chum ESU / Salmon Creek Activity: Supplementation				
Location of hatchery activity: Dungeness Hatchery / Salmon Creek Hatchery **Dates of activity: August -May Hatchery program operator: WDFW, Wild Olympic Salmon**				
Type of Take	**Annual Take of Listed Fish By Life Stage *(Number of Fish)***			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)			500	300
Collect for transport b)				
Capture, handle, and release c)			1230	
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)			240	
Intentional lethal take f)				
Unintentional lethal take g)			30	
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.